Transmission of PEDV in Growing Pigs

Kelly Lager, Kimberly Crawford, Laura Miller

Virus and Prion Research Unit

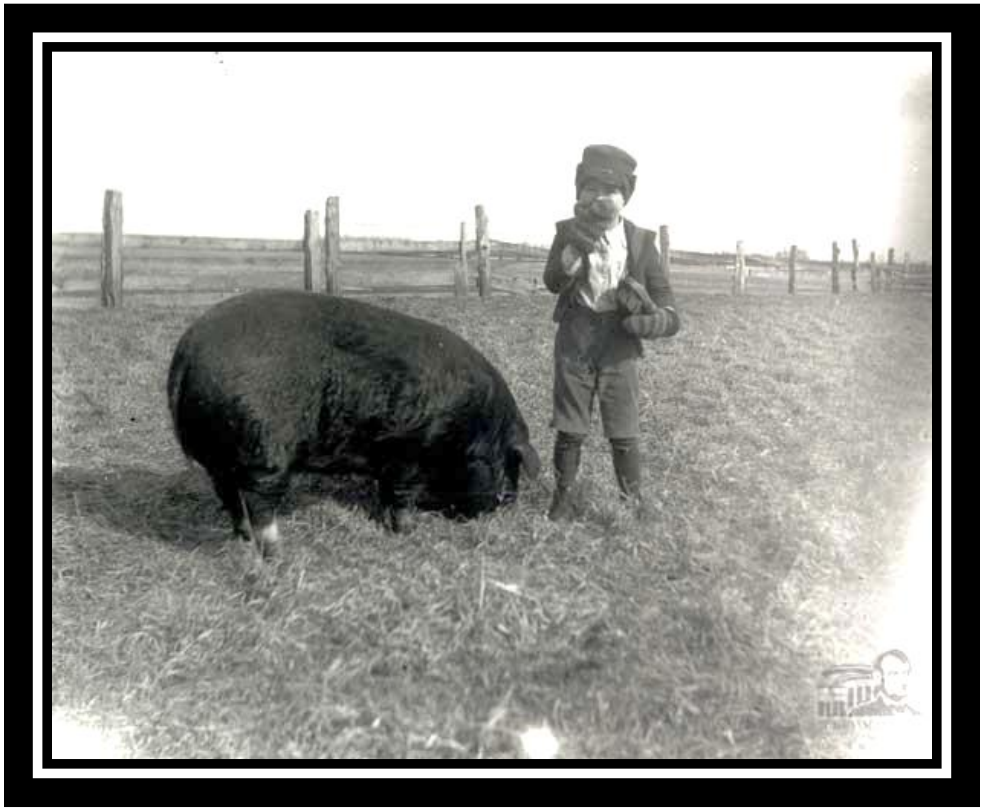
National Animal Disease Center

Agricultural Research Service, USDA

Ames IA, USA.

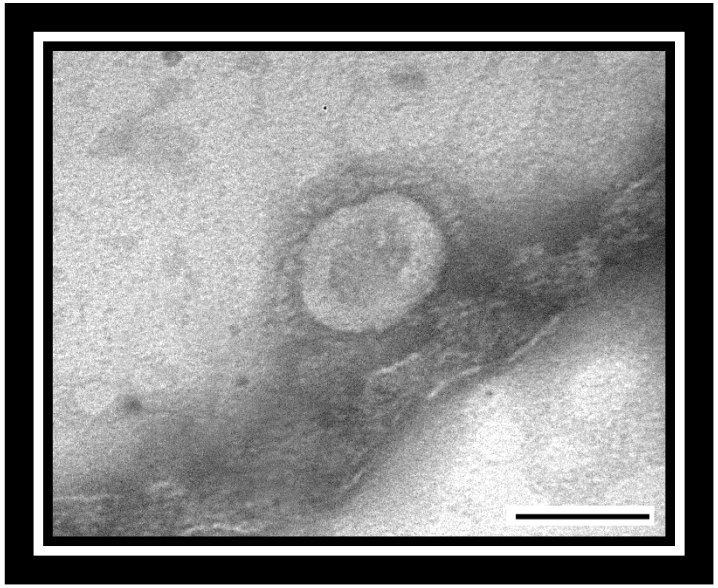
It took Mother Nature about
50 million years to make a pig

It took Man about 5 thousand years to domesticate swine



It took Man about 50 years
to industrialize swine production

It takes Mother Nature hours to make a new virus!



Porcine Epidemic Diarrhea Virus (PEDV)

- USA / Research Perspective
- Field reports – Epidemic
  Endemic
- Experimental data
- Reality vs. Research

Research Challenges

- Limited resources
- Most important questions
- Complement the research of others

PEDV Control

- Stop transmission of virus to susceptible pigs
  - Eliminate virus
  - Develop Protective Immunity

Field Reports

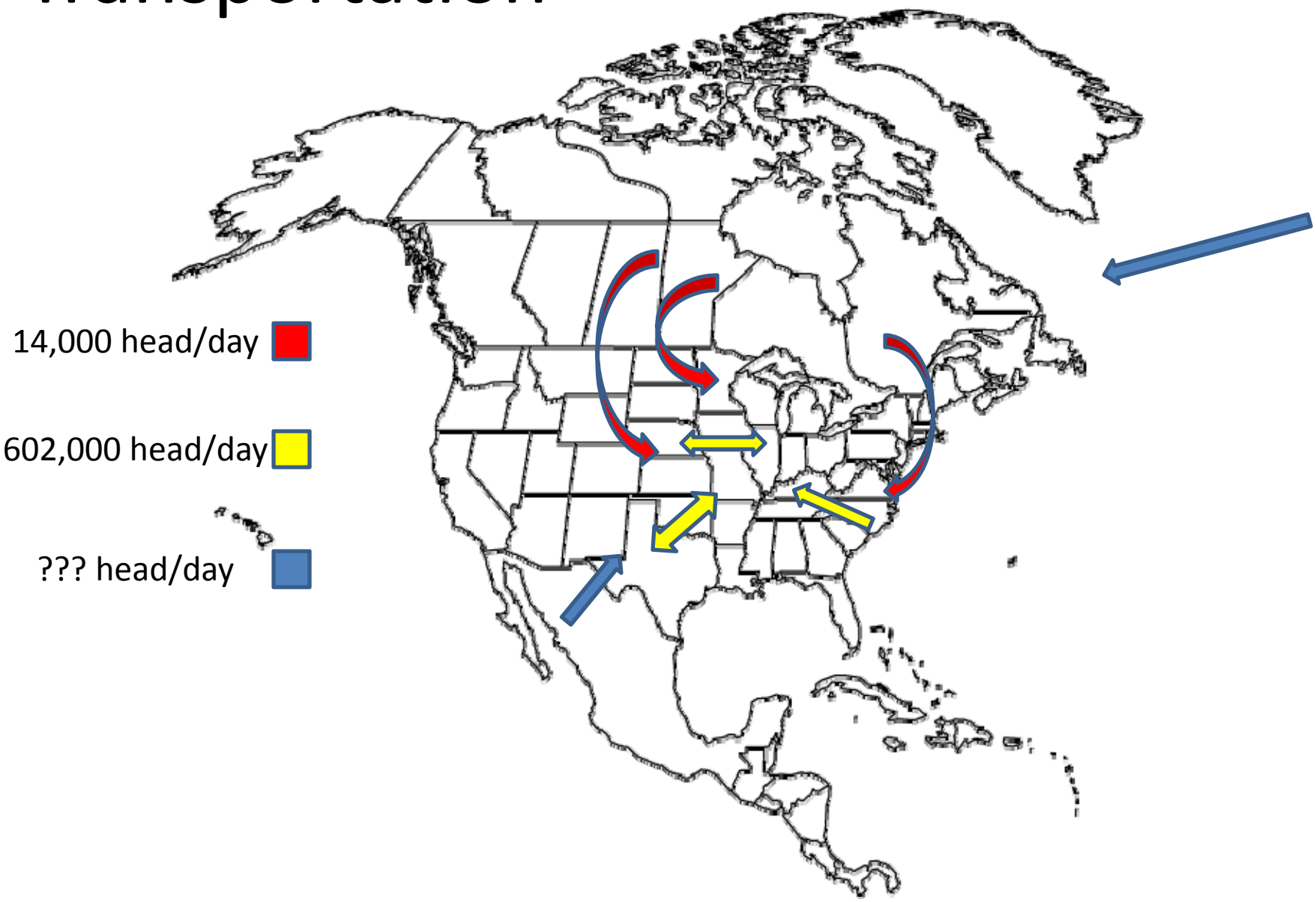
- Epidemic Disease
  - Rapid spread through USA
  - Very fast through some large production systems
    10 days > 20,000 sows
  - Some production systems not infected yet

- Endemic Disease
  - Stable Status
  - Unstable Status

Epidemic Transmission

- Pig to Pig – Direct Contact
- Indirect contact within same building/site
- Potential Area Spread
- Transport
- Feed

Transportation



PEDV USA to Canada

Janurary 24, 2014

PEDV China to USA?

Environmental Stability Infectious PEDV

- Feces 7 days
- Slurry 25C 14 days
  4C 28 days
- Dry feed 7 days
- Wet feed 28 days
- Drinking water 7 days

Goyal, 2014 National Pork Board Project 13-215

Indirect Spread

- Alonso et al. Veterinary Research 2014, 45:73
  Aerosol collection of samples in room of experimentally infected pigs = infectious virus

  Aerosol collection of field samples downwind of positive sow barns = PCR positive, but not infectious

- Hesse et al. National Pork Board 13-228
  Indirect spread in isolation room experimentally infected pigs

Endemic Disease

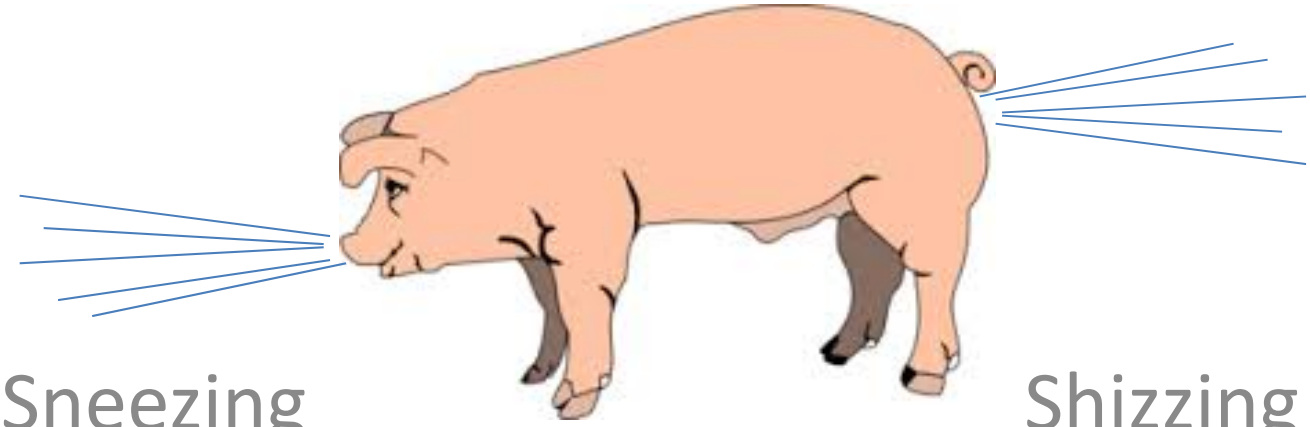
- Following epidemic phase in most sow herds neonatal pig loss returns to normal in 6-8 weeks
- Some sow herds have “small” breaks of PEDV in neonatal pigs
- Cyclical pattern to re-breaks?
- Post epidemic reports of sows becoming seronegative in several months –susceptible to re-infection?

Endemic Transmission

- Pig to Pig
- Environment
  - Reports of herds going negative for infectious virus based on introduction of naïve pigs
  - 90-150 days to clear virus from herd

PEDV Transmission - Feed

- Mixed opinions
- Mixed experimental results and conclusions
- Others working in this area



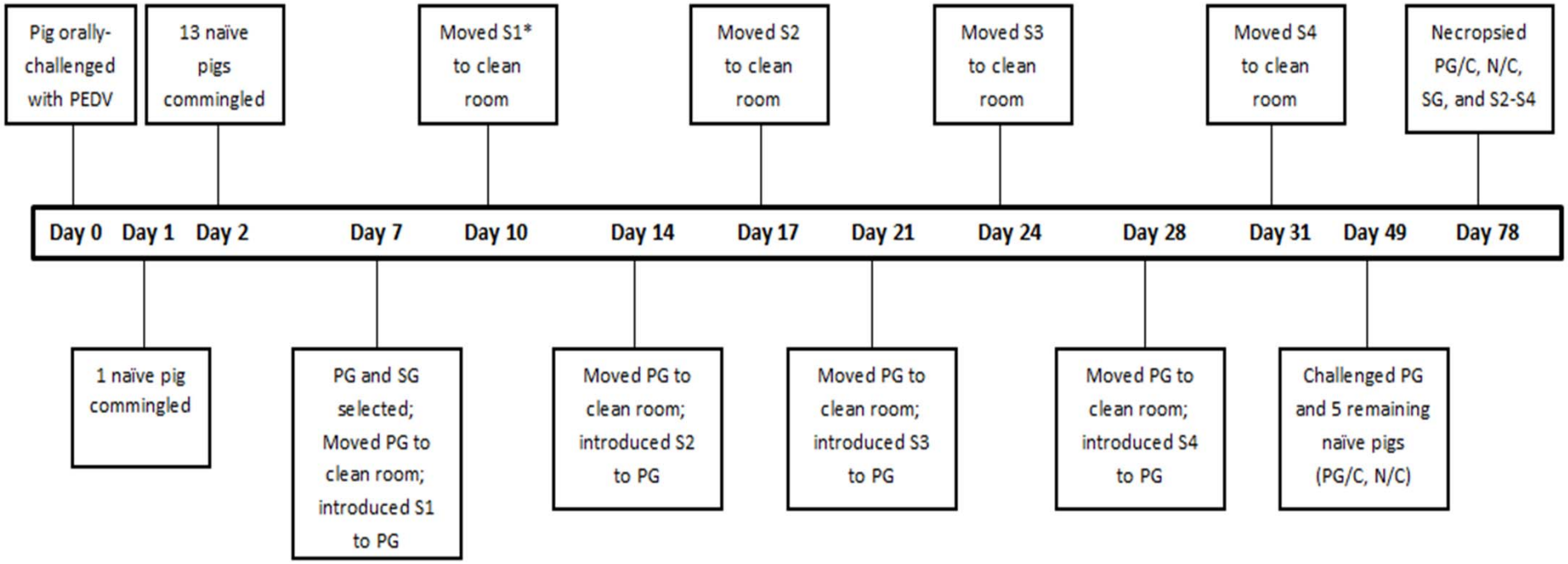
Duration of shedding infectious virus ?

Potential Area Spread?

Duration of immunity? Sow? Colstrum?

Young pig infection model

- Day -7 3-week-old PEDV pigs from PEDV negative sows
- Day 0 Challenge of 4-week-old pigs PEDV CO 2013 isolate
- Day 0-35 Collect Rectal Swabs
- When negative – homologous challenge
- Weekly bleed
- Sentinel Pigs



Stationary Group = SG

Principle Group = PG

Sentinel Pig = S1-S4

Naïve Challenge Group = N/C

Young pig model

- Rapid transmission from seeder pig to 100% small group
  - Less than 24 hours Rectal swabs positive
- Mild to moderate diarrhea 2-7 days post exposure
- Shed infectious virus to single contact
  D7 & D14
- Homologous protection at 7 weeks post wild-type virus infection

Young pig model

- Homologous protection at 7 weeks post wild-type virus infection
- “Vaccinated” pigs no positive rectal swabs
- Naïve challenged pigs rectal swabs 5/5 positive (6-10 days)
- Any differences between “natural” vs. experimental infection
- This study supports NPB 13-228

Eliminate Infectious PEDV in isolation room

- First Day
  - Cleaning room
  - Foaming with Virkon
  - Dry
- Second Day
  - Foaming with Virkon
  - Dry
- Ready to go for naïve pigs

Control of PEDV

- Stop transmission of virus to susceptible pigs
  - Eliminate virus
  - Develop Protective Immunity
    - Feedback to induce wild-type infection in sow herd

Feedback Sow Immunity

- Duration of protective immunity in sows following feedback at least 4-5 months in field conditions
  Murtaugh et al 2014 National Pork Board 13-262

- Clement et al. 2014 National Pork Board 13-263
  Sow field study early data supports NPB 13-262

Vaccine

- Harrisvaccines, Inc June 16, 2014
  Replication Defective Vector

- Zoetis September 3, 2014
  inactivated whole virus vaccine